

Patent claims:

1. A process for joining at least two substrates, in particular having electrical, semiconducting, mechanical and/or optical components, comprising the steps of
5 providing a first substrate,
producing a joining element on a first surface of the first substrate,
providing a second substrate, and
10 joining the first and second substrates by means of the joining element.
2. The process as claimed in claim 1, in which the joining element is deposited on the first surface of the first
15 substrate and is joined to the first substrate while it is being deposited.
3. The process as claimed in one of the preceding claims, in which the joining element is applied to the first surface
20 of the first substrate by evaporation coating.
4. The process as claimed in one of the preceding claims, in which a frame is applied by evaporation coating as the joining element.
25
5. The process as claimed in one of the preceding claims, in which one or more supporting elements are produced inside the joining element on the first surface of the first substrate.
30
6. The process as claimed in one of the preceding claims, in which a plurality of nested frames are applied by evaporation coating as the joining element.

7. The process as claimed in one of the preceding claims,
in which the step of producing the joining element comprises
deposition of a binary material system by evaporation
5 coating.

8. The process as claimed in one of the preceding claims,
in which a glass layer is applied by evaporation coating and
structured through a mask to form the joining element.
10

9. The process as claimed in one of the preceding claims,
in which the joining element is structured by means of the
lift-off technique.

10. The process as claimed in one of the preceding claims,
in which the joining element and the second substrate are
adhesively joined, soldered or bonded.
15

11. The process as claimed in one of the preceding claims,
in which the joining element and the second substrate are
joined by means of anodic bonding, fusion bonding, sol-gel
bonding or low-temperature bonding.
20

12. The process as claimed in one of the preceding claims,
in which
25 the first and second substrates comprise a first and second
wafer, respectively,
a multiplicity of laterally adjacent joining elements are
produced on the first surface of the first wafer, and
30 after the first and second wafers have been joined to form a
wafer assembly, the wafer assembly is diced into individual
chips.

13. The process as claimed in one of the preceding claims, in which a cavity is formed between the first and second substrates and inside the frame.

5

14. The process as claimed in one of the preceding claims, in which interconnects are arranged on the first surface of the first substrate, and the joining element is applied to the first surface by evaporation coating in such a manner
10 that the interconnects are at least partially covered.

15. The process as claimed in one of the preceding claims, in which the interconnects extend laterally or vertically through the joining element.

15

16. The process as claimed in one of the preceding claims, in which the joining element is planarized after it has been produced on the first surface of the first substrate.

20 17. The process as claimed in one of the preceding claims, in which alignment elements are produced on the first or a second surface of the first substrate, the second surface being on the opposite side from the first surface.

25 18. The process as claimed in one of the preceding claims, in which a multiplicity of substrates are jointed to form a stack.

30 19. A composite element, in particular having electrical, electronic, semiconducting, mechanical and/or optical components, and in particular produced using the process as claimed in one of the preceding claims, comprising

a first substrate,
a joining element on a first surface of the first substrate,
a second substrate,
the first and second substrates being joined by means of the
5 joining element.

20. The composite element as claimed in claim 19, in which
the joining element is deposited on the first surface of the
first substrate and is joined to the first substrate.

10

21. The composite element as claimed in one of the preceding
claims, in which the joining element is applied to the first
surface of the first substrate by evaporation coating.

15 22. The composite element as claimed in one of the preceding
claims, in which a frame is applied by evaporation coating as
the joining element.

23. The composite element as claimed in one of the preceding
20 claims, in which one or more supporting elements are arranged
on the first surface of the first substrate within the
joining element.

24. The composite element as claimed in one of the preceding
25 claims, which comprises a plurality of nested frames as the
joining element.

25. The composite element as claimed in one of the preceding
claims, in which the joining element comprises a binary
30 system of materials.

26. The composite element as claimed in one of the preceding
claims, in which the joining element comprises a structured

glass layer.

27. The composite element as claimed in one of the preceding claims, in which the joining element is structured by means
5 of the lift-off technique.

28. The composite element as claimed in one of the preceding claims, in which the joining element and the second substrate are adhesively joined, soldered or bonded to one another.
10

29. The composite element as claimed in one of the preceding claims, in which the joining element and the second substrate are joined by means of anodic bonding, fusion bonding, sol-gel bonding or low-temperature bonding.
15

30. The joining element as claimed in one of the preceding claims, in which
the first and second substrates comprise a first and second wafer, respectively,
20 a multiplicity of laterally adjacent joining elements are arranged on the first surface of the first wafer, and the joining elements are joined to a surface of the second substrate.

25 31. The composite element as claimed in one of the preceding claims, in which a cavity is formed between the first and second substrates and inside the frame.

32. The composite element as claimed in claim 31, in which
30 the cavity is hermetically sealed.

33. The composite element as claimed in one of the preceding claims, in which interconnects which are at least partially

covered by the joining element are arranged on the first surface of the first substrate.

34. The composite element as claimed in one of the preceding
5 claims, in which the interconnects extend laterally or vertically through the joining element.

35. The composite element as claimed in one of the preceding
10 claims, in which at least one surface of the joining element is planarized.

36. The composite element as claimed in one of the preceding
15 claims, in which alignment elements are arranged on the first or a second surface of the first substrate, the second surface being on the opposite side from the first surface.

37. An intermediate product for producing the composite
20 element as claimed in one of the preceding claims, in particular having electrical, electronic, semiconducting, mechanical and/or optical components, comprising
a first substrate,
a joining element on a first surface of the first substrate,
the joining element being designed in such a manner that the
first substrate can be joined to a second substrate by means
25 of the joining element.

38. A stacked composite element, comprising a multiplicity
30 of composite elements as claimed in one of the preceding claims which are joined to one another.

39. The use of a structure for joining two substrates which
is applied by evaporation coating as a spacer between two
substrates or as an alignment element, in particular in

accordance with a process and/or for producing a composite element as claimed in one of the preceding claims.

40. A process for joining substrates having electrical or
5 optical components, in particular as set forth in one of the preceding claims, in which

a first and a second substrate are provided,

in a first step, a frame is applied to at least one
surface of the first substrate, glass being used as material
10 for the frame and the glass being applied by evaporation coating, and

in a second, subsequent step, a surface of the second
substrate is joined or bonded to the frame, a cavity being
formed between the first and second substrates and inside the
15 frame.

41. A composite element, in particular having electrical or
optical components on a substrate, in particular as set forth
in one of the preceding claims, comprising

20 a first and a second substrate,

at least one frame which has been applied to a surface
of the first substrate, the frame comprising a structured
glass layer which has been applied by evaporation coating,
and

25 a joining region in which a surface of the frame is
joined or bonded to a surface of the second substrate,

a cavity being formed between the first and second
substrates inside the frame.